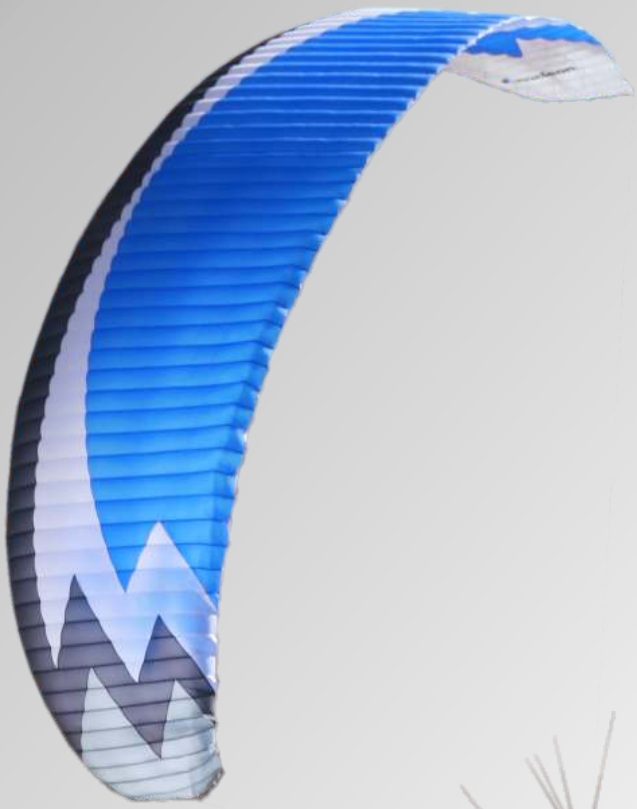
user
manual

Nucleon WRC



DUDEK paragliders

www.dudek.eu

NOTE!
Please read this manual carefully before your first flight

Very important!

Before use it is vital to check in which configuration the steering lines and pulleys are currently set (lower or upper hangpoints) and adjust them to your preferences if necessary.
The risers have three points to fix the pulleys on – lower, middle and upper one (see risers on page 36). On each main steering line there are two points marked, lower and upper, to fix the steering handle according to position of the pulley.
Steering lines must not not push down the trailing edge when not operated – this must be observed in all possible configurations of trimmers and speed-system.
Steering lines must have a couple of centimeters play before they engage affect the canopy (see section 3.1 on the proper adjustment). For sake of safety it is always recommended to set the brakes rather too loose than too tight. Make sure they are set symmetrically, too.
Ill-adjusted steering lines may cause you to misinterpret the canopy's behaviour in flight, and in case of encountering turbulence in accelerated flight dangerous collapses may occur (see page 20).

When flying at full speed (trimmers opened / trimmers opened and speedbar pushed), especially in uneasy air, it is highly recommended to steer the paraglider using alternative steering methods like TEA or ALC+ only.
With increasing speed an effect of „inverting" the profile when trailing edge is being pulled down emerges (pulling the brakes, see page 20). That effect can cause dynamic collapses, especially at full speed.
The safest way to change your course at high speeds is to use the TEA lines, or (in the order of safety) the ALC+ handles. Any steering inputs should be smooth and easy, without sharp and/or deep movements. Such actions can dynamically change pressure distribution over the airfoil, leading to collapses.

These warnings affect every paraglider and Nucleon WRC is no exception!

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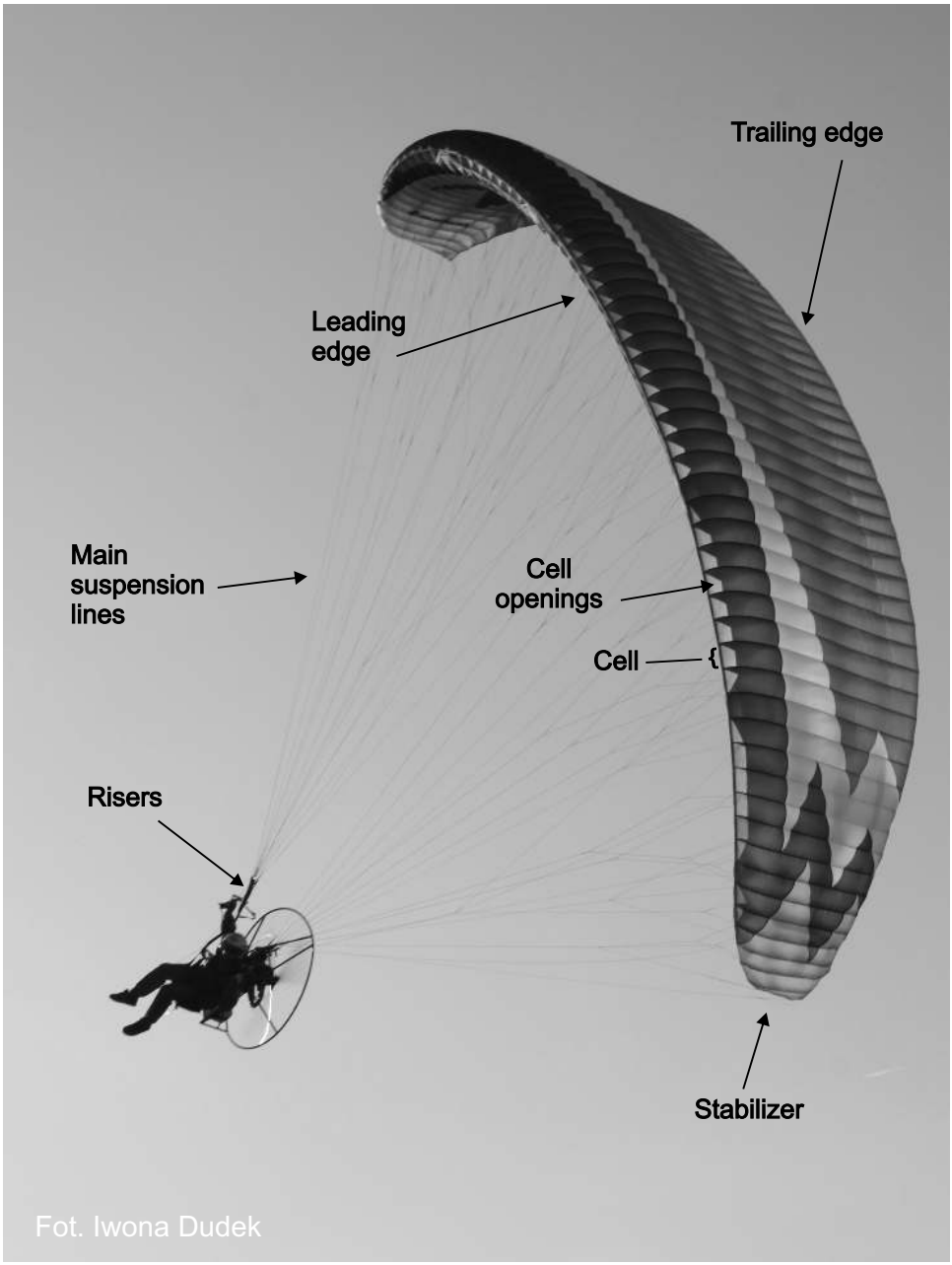

Trailing edge
Leading edge
Main suspension lines
Cell openings
Cell
Risers
Stabilizer
Fot. Iwona Dudek

1. INTRODUCTION

CONGRATULATIONS

We are pleased to welcome you among the growing number of DUDEK PARAGLIDERS pilots. You've become a proud owner of state-of-the-art PPG paraglider. Extensive development, application of the most modern methods and thorough testing resulted in a friendly behaving paraglider, offering the pilot a lot of fun combined with great performance.

We wish you many enjoyable and safe flying hours.

DISCLAIMER

Please read this Manual carefully and note following details:

- The purpose of this Manual is to offer guidelines to the pilot using the paraglider and it is by no means intended to be used as a training manual for this or any other paraglider.
- You may only fly a paraglider when qualified to do so or when undergoing training at an accredited School or with an Instructor.
- Pilots are personally responsible for their own safety and their paraglider's airworthiness.
- The use of this paraglider is solely at the user's own risk! Neither the manufacturer nor dealer do accept any liability connected with this activity.
- This paraglider on delivery meets all the requirements of the EN 926-1 and 926-2 regulations or has an airworthiness certificate issued by the manufacturer. Any alterations to the paraglider will render its certificates invalid.

NOTE

Dudek Paragliders warns that due to constant process of development the actual paraglider may differ slightly from the one described in the manual.

2. THE WING

WHO SHOULD FLY Nucleon WRC?

You have been paramotoring for some time now. You know and appreciate performance and safety of the reflex-aerofoil paragliders. Even if you are currently flying only for fun, long routes are attracting you no less than a wish to prove yourself against the best international competitors, or to beat some record. You are not afraid of strong thermals, and the agility tasks close to the ground look promising too.

What you need is a top-drawer paraglider; a canopy that will be safe and stable both at top and low speeds, with with efficient trimmers and speed system, as well as a precise steering, capable of quick reversing your paraglider. On top of that it has to be robust, so that high loads occurring at frequent PPG flying will not cause any deformations of the surface.

If most of the above statements do apply to you, then the Nucleon is your wing!

2.1 DESIGN

Nucleon is an Action and Reaction class paraglider, built around a new idea already proven in Synthesis and Plasma. The new concept assumes linear characteristics of acceleration (equally shared between trims and speed system) and limited reflexivity at slow trim settings. It is accompanied by a number of new design features, intensively tested since 2007 and introduced into mass production for the for the first time in the world. As a result we have a 100% reflex PPG paraglider with great performance and outstanding safety (comparable to the already legendary Reaction), featuring handling similar to classic paragliders (at low speeds). The Nucleon WRC takes off perfectly, rising fast and clean after an easy inflation.

We are positively sure that the Nucleon is currently the best paraglider in its class.

The fundamental feature of a good PPG canopy is its great stability and tuck-resistance. When this is achieved, the user does not have to concentrate all the time on piloting in turbulent air, thus saving energy for navigation, taking pictures or simply enjoying the flight. In addition the faster and safer your paraglider is, the more often you can fly. While the Nucleon was designed to retain features of a classic paraglider, the application of a reflex aerofoil section added several new qualities. First of all, using that profile means that the wing stability does not depend exclusively on the pilot. It maintains a stable pitch attitude, rising and falling through thermals while remaining stable above your head, without need for so much pilot input. Generally speaking the reflex profile is a special kind of aerofoil section. The specific static pressure distribution creates a situation where at low attack angles, only the wing fore part (some 60% of the chord) is producing lift, while the rear 40% of the chord creates an effective stabiliser against

excessive decrease of the attack angle. The trimmer system allows for considerable raising the rear part of the airfoil, thus effectively reducing its projected chord and surface area by some 30%, giving the paraglider a higher wing loading and increasing its speed. The centre of pressure also moves forward, adding enhanced pitch stability. Such a shift of loading gives the Nucleon an exceptional tuck-resistance and increases its projected aspect ratio, resulting resulting in much better performance, especially at high speeds. Should you require more lift, the rear section can be pulled down to restore an airfoil that will be effective along its entire chord.

The WRC version (With Rod Concept) incorporates Dudek Flexi Egde technology.

Some minor modifications in the design (improving curvature among others) caused the wing to be more agile. Exchanging mylar reinforcements for elastic rods results in easier inflation and stiffens the leading edge. Increased speed ranges are another advantage of that improvement. ALC+ (new version of the ALC steering system) is more efficient and affects the canopy in more proportionate way. In effect steering appears to be smoother.

Those modifications should be welcomed especially by the competitors, seeking both for faultless launches and agility.

2.2 STRUCTURE

The Nucleon 3D body was designed in our **CSG** (Canopy Shape Guard) system, comprising many elements resulting in exceptional coherence and stability of the shape. Below you will find a short description of CSG subsystems.

Nucleon has an elliptical planform with slightly rearward swept tips. The cells are divided with ribs additionally supported by diagonal **VSS** (V-shaped supports) system. Such arrangement ensures a smooth top surface, exact aerofoil reproduction across the entire wingspan and yet more importantly, minimal number of suspension points.

The lower surface has a **RSS** (Reinforcing Strap System) applied in the wing's interior. RSS is an ballooning-independent reinforcements system, made entirely of paragliding fabric, stiffening and stabilizing entire canopy structure.

Nucleon' aerofoil is another product of our **DRA** (Dudek Reflex Airfoil) technology. It was calculated with our previous experiences in mind and thoroughly tested with numerical methods.

Properties of a reflex airfoil were described above. The suspension points areas are additionally reinforced with laminated fabric so that loads are equally distributed on three planes: vertically (through the ribs), diagonally through VSS system and level through the RSS.

All crossports have been prepared using **OCD** (Optimised Crossports Design) technology. Carefully designed shapes of the openings and their optimal placement between stress lines guarantee very efficient pressure distribution in the canopy and its quick inflation. These openings are scaled together with the ribs, so that their replicability is flawless and they do not disturb the aerofoil in any way. The Nucleon leading edge is closed to airflow, and its precise shape is guarded by reinforcements of laminated fabric.

Another feature of the Nucleon WRC is the Flexi-Egde technology. The leading edge is closed to the airflow, and its precise shape is kept with laminated cloth reinforcements, incorporating synthetic rods. The rods make the leading edge stiffer and smoother, bringing improvements in many areas - from easier inflation, through stiffening the canopy in flight to improved general airflow.

Cell openings are positioned on the undersurface in the vicinity of the leading edge. Their exact placement was very carefully selected, so that they got maximum ram effect in as many flight situations as possible.

On the wingtips we placed the **ACS** (Auto Cleaning Slots) - dedicated slots automatically removing dirt from inside the wing.

Careful selection of modern fabrics and design solutions brings about great strength and durability of the Nucleon. All materials used come from marked production batches, and each production step can be verified down to identification of specific worker and controller.

Nucleon WRC is manufactured under new technology, utilizing precision of the laser cutter. All stages of production process take place in Poland under strict supervision of the designer himself, thus ensuring highest European quality.

Fabric

The upper surface is made of 38 and 41-gram Dominico Tex cloth. Lower surface is made of 34-gram Dominico Tex cloth, contributing to low weight of the canopy.

The ribs must be as rigid and stretch-resistant as possible. We found these qualities in Porcher Skytex Hard cloth with E29A impregnate (40 g/m2). All suspension points and leading edge reinforcements are made of SR-Scrim fabric.

Rigging system

All of the Nucleon suspension lines are sheathed by a coloured polyester layer which is covering a brownish Technora core. Low number of lines required such composition, featuring high strength and stretch-resistance of the lines.

The rigging system consists of individual lines looped and stitched at each end. The upper level lines start at the attachment points.Cascade-wise they are joined by twos or threes to middle layer lines. These in turn connect by twos or threes to main suspension lines, which are attached to the risers with triangular quick links (maillons). To prevent their slipping off, the lines are kept together with a rubber 'O ring'.

Technora.

All the maillons are made of corrosion resistant, polished stainless steel, ensuring excellent strength and durability. We use only the best quality, certified maillons by Peguet.

Stabilo lines run from the outer suspension points to the maillons through consecutive cascades as well. The same story goes for the steering lines. They run from the trailing edge through several layers to the main steering lines, which are lead through the pulleys connected to the rear risers and then fixed to the brake handles. Steering lines do not carry any load.

PEGUET

Some of the steering lines of the upper level are additionally led through rings sewn into the trailing edge, shortening it when the brake is applied, so that steering becomes lighter and more effective.

All the lines are distinguished by colours depending on their strength:

- 2,3 mm; strength: 420 daN; colour: celadon (willow green),
- 1,8 mm; strength: 280 daN; colour: red and orange (the latter for pulling big ears),
- 1,5 mm; strength: 190 daN; colour: violet,
- 1,3 mm; strength: 140 daN; colour: green,
- 1,2 mm; strength: 90 daN; colour: blue.

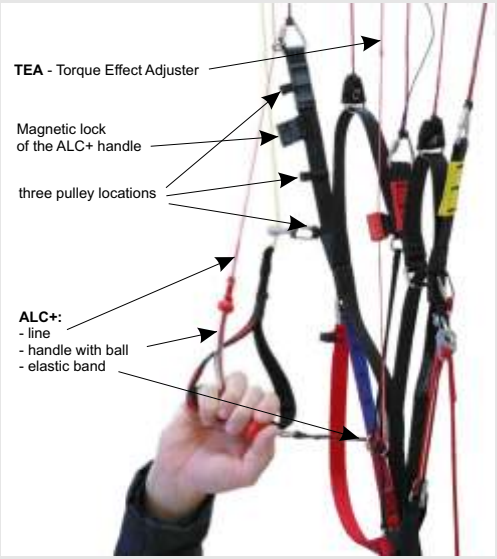
(given colours are subject to slight changes).

ALC+
Alternative Steering System

ALC+ allows for aggressive turns even on full speed, without modifications of the reflex profile.

This is of special importance when flying in turbulences with open trimmer and speed system engaged. Additionaly it is important for bigger canopy sizes, without special solutions demonstrating problems associated with big steering forces and low agility.

Steering is executed by a handle finished with red balls, easily accessible in all suspension modes.



ALC+
Alternative Steering System

Two examples how to handle ALC+

ALC+
Alternative Steering System

Using the magnetic lock of the ALC+ handle

Easy Catch

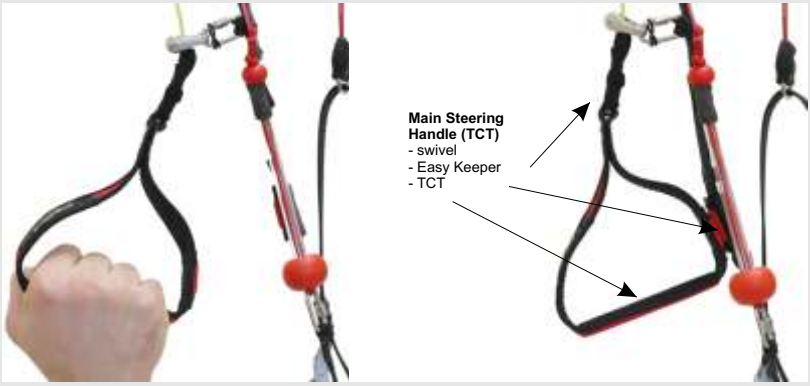
"Easy Catch" speedbar is a godsend for those who have problems catching the bar after taking off. The speedbar is designed to stay always in front of the speedsystem lines. Its finish is very robust, so long-term service is guaranteed.

Triple Comfort Toggle

Neodymium magnet of the Easy Keeper
Swivel protects the steering line against twisting
slit of the rod
exchangeable insert
half-rigid PVC tube
rigid plastic rod
The most soft handle is obtained when no insertion is used.

Addressing different needs of our clients we have created a TCT system - Triple Comfort Toggle, making it possible to have your brake handles in rigid, half-rigid or soft configuration without need to purchase additional handles.

Easy Keeper



Easy Keeper is our indigenous way to hold the brake handles at the risers by using strong neodymium magnets. It keeps the handles firmly at the risers, while both attaching and releasing goes smoothly and easily. The system allows for easy placing the brake handles on risers during flight, when they are not used, thus minimalizing danger of getting them into running propeller.

Especially in turbulent air use only the ALC+ system (usage of the main brakes considerably increases possibility of collapses).

THE RISERS

For the Nucleon WRC we have chosen four-way risers equipped with:

- **ELR** (Easy Launch Riser) system. This is an specially marked A riser (yellow ribbon),
- speed-system affecting A, B and C risers when engaged, featuring ball-beared pulleys and special line;
- trimmers of red band with visible scale (red – slow and blue – fast trim setting), designed for quick and easy replacement in case of deterioration;
- various levels of the pulleys, to be used depending on the hangpoint level;
- ALC+ allows for effective turns even at high speed, without distorting reflex profile too much. Steering is done with dedicated handle with red balls, fixed on the risers with a magnetic clip (prior to the start).
- TEA -Torque Effect Adjuster – allowing for eliminating the effect of engine torque, tending to turn the paraglider in the direction opposite to the propeller's rotation. The system can be adjusted to match your specific combination of paramotor/propeller.

For quick and easy recognition in emergency, some of the risers are distinguished with coloured band as follows:

A - yellow (used for launching)
A' - black neoprene (used for big ears)
B - red (used for B-stall)
D - grey (needed to keep the glider down in strong wind – aborted launch).

Main A row suspension lines connect to an A riser (yellow) and A' (black neoprene). B row and stabiliser lines go to B riser (red), C lines go to C riser (black neoprene) and D lines to D riser (grey), as well as steering lines (through their pulleys).
Brake handles are attached to the steering lines at optimal point, guaranteeing safe and effective operation. On the main brake line there are two point marked, higher and lower, to be used depending on the harness hangpoint level.
On adjusting the steering lines see chapter 3.1.

Our newest brake handle used in Nucleon WRC besides its attractive, light design, features:

- a swivel – preventing possible twisting of the steering line,
- TCT (Triple Comfort Toggle) system,
- EK (Easy Keeper) system – see further pages

3. FLIGHT OPERATION

3.1 STEERING LINES AND SPEED SYSTEM ADJUSTMENT

We strongly advise following actions to be supported by an instructor or at least an experienced pilot.

The Nucleon's risers are shorter than in most paragliders, thus alleviating potential problem with different hangpoints. There are three places to fix the steering lines pulley – high, low, and middle (see risers diagram on p. 36). On the main steering line there are two points marked – lower and higher, indicating where to fix steering handle depending on pulley placement.

CAUTION! Before first use check whether steering lines and pulleys are set for higher or lower hangpoint, and adjust them to your preferences if necessary.

When flying with low hangpoint (or without paramotor) fix the pulleys to upper loops on the risers, and the steering handles on upper positions marked on the steering lines (so that steering lines are effectively shortened).

Upper hangpoints require longer steering lines, while the lower hangpoints – shorter lines.

Before you will take on powered flight it is recommended to try the setup out. Hang up the entire PPG unit with ropes, sit in the harness and have someone pull up the risers. You must make sure that in flight you will always be able to reach the brake handles, even if the airflow blows them away. Being suspended in this way you have a perfect opportunity to adjust the speed system too. The speedbar should not be pulling pull its lines nor risers when not applied. Neither should it be too loose, for it could catch the propeller. An additional way to check the whole configuration out is to visit the take-off site in steady winds of 3-4 m/s. With the engine off, inflate the wing and take it up over your head. When it stabilises, check that the brakes are loose and do not pull the trailing edge. There should be a spare inch or so before they activate.

Remember that it is always safer to set the margin of play too big than too small. And, most importantly, the setting must always be symmetrical.

3.2 FREE FLYING

Although the Nucleon according to its design book is a fast PPG wing, , it behaves surprisingly well as a classic paraglider too and can be used as such without any modifications.

The essential difference between Nucleon and classic paragliders means that due to its increased tuck-resistance (both during start and flight) and greater speed range it can be safely flown in strong conditions too.
Generally speaking the faster you fly, the safer is your flight.

3.2.1 TAKE-OFF

In case of **classic launch** we recommend that after laying out the wing all lines be taut, eliminating excessive play. The Nucleon is pulled up with A risers only. It is best done with closed trimmers (slow setting), in case of stronger wind you can free the trims a bit. Applying steady and equal pressure on both A risers move forward. The wing practically does not overshoot, so the front collapses that otherwise happen quite often at launches are rarely seen with Nucleon. Instead it kind of waits for you to catch up with it.

In case of **reverse launch** we also recommend trimmers to be set as described above. Due to lack of overshooting the take-off is easy, pilot has only to brake slightly before his turn. Reverse launches can be executed without any problems even in weak wind (1,5 m/s).

CAUTION During take-off it is important to keep the risers under pressure until almost airborne. Reflex profile used has an inherent tendency to increase the angle of attack. In effect, Nucleon can behind the pilot when not pulled up appropriately.

3.2.2 FLIGHT

The increased speed range of Nucleon may demand some attention in flight. Nevertheless, once you have mastered these additional assets, flying will become pure fun. Good handling will let you make best use of thermals, and increased speed on transitions means that your presence in sinking air will be shorter. To avoid stalls when braking with slow trims setting (red area), their movement is restricted by the tape sewing (Note: it is possible to push the sewn tape through the buckle with both hands to replace it, but normal operation range is restricted by said place).

When the trims are fully opened (blue area) the wing becomes faster and stiffer, increasing its stability even more. The brake forces increase too, as well as the brake travel to the stall point. The radius and bank angle in turns grow proportionately to the growing brake forces. When the are set fast (or fully opened) and the wing is not flown near the ground, a switch to ALC steering is strongly recommended - especially in the rough air.

ALC system can be used in all speed system & trim configurations, also in combination with main steering handles.

Speed system use

Full application of the speed system increases flight speed by some 30%. In contrast to most paragliders it does not decrease wing stability, in fact the Nucleon seems to counter the turbulences even better.

Still, if you meet some serious trouble, it is advisable to release the speedbar. With application of the speed system the brake forces increase, and brake effectiveness decreases considerably.

At maximum speedbar and fully opened trims we strongly recommend steering with ALC system. Turns executed in this way will be slightly wider, but strength needed to initiate the turn will be smaller and there will be no decrease in speed. It is advised to use the speedsystem with fully or half opened trimmers. **Using speedbar with closed trims (red area) can lead to a frontstall.**

3.2.3 LANDING

With closed trimmers (red area) Nucleon lands like any other paraglider. The brake forces, initially low, are growing proportionally through all range, giving ample warnings before possible stalling. Still you should be careful when flying very slow, until fully familiar with brake operation.

When landing with trims set fast, above “0” point (blue area) slowing down can require more space than usual. The paraglider has a lot of kinetic energy and energy and careless application of brakes may even cause the wing to climb.

Most pilots get to know the wing relatively fast and quickly gain enough trust to fly it in stronger conditions than they ever did. Still, you should always be careful when flying low. Remember that Nucleon flies faster than ordinary paragliders and sometimes it can be of importance (e.g. when landing on a slope).

After landing in strong wind the paraglider can be safely put down with B risers, or with a strong pull on the rear D risers.

3.2.4 WINCHING

Nucleon was not designed for winching. As mentioned before, reflex profile used has an inherent tendency to increase the angle of attack. While in normal flight such a disposition makes it safer, it can be dangerous during winch start. Nevertheless, a lot of successful winches on Nucleon have been made.Experience shows that it should only be done with trims set at “0” or above (faster settings - blue areas).

To sum it up: winching can be done, but proper attention must be paid.

3.3 POWERED FLIGHTS

NOTE: Before each start it is necessary to have a thorough check of the paraglider,harness and power unit.

In powered flight most of the wing characteristics remain as described above (chapter 3.2). Still there is additional information needed, concerning power output, proper matching of the wing/engine/propeller etc. Dudek Paragliders cannot take responsibility for all possible combinations, but if you contact us we are always ready to help.

First flights

In order to get familiar with your wing we recommend flying with closed trimmers first (read area up to “0” position), because in this configuration Nucleon behaves as a classic wing. Flying like that try pulling the brakes some until you feel resistance, usually it will be at about 1/4 of the brake travel. Once you feel confident with your wing, you can start experimenting with faster trim settings and speed system. Learn to use all of the additional speed and safety of the Nucleon.

3.3.1 TAKE-OFF

Classic launch with no wind

Even when it seems that there is no wind at all, it is rarely so. Therefore always be careful in determining the conditions, since in PPG flying it is most important that the launch and initial climb are performed with a head wind (the danger of losing your airspeed while crossing the the wind gradient is greatly reduced). Special attention must be paid to trees, power lines and other obstacles, including the possibility of emerging rotors.

Paraglider preparation

Lay out the paraglider downwind of the power unit, with all suspension lines taut and pointing toward center of the power unit. The risers are to be laid on the ground. Set the trimmers completely closed. In conditions faster settings can be advised (blue areas). Make sure that you warm up the engine while standing windward of the wing. Stop the engine before clipping in the risers.

Now have a quick check if:

- the helmet is on and locked,
- the risers are clipped in the carabiners,
- the trimmers are properly set,
- the ALC+ handles are fitted to the risers by magnetic lock
- nothing will get in propeller's way,
- speed system is running without problems,
- steering lines and handles are free and not twisted,
- the engine delivers full power,
- take off area is clear of obstacles and free to use.

When you are sure everything is OK, you can clip in the wing and execute launch as described in paragraph 3.2.1.a.

From now on you should steer the paraglider facing forward, without looking back over your shoulder (when the wing is low behind you, turning can cause some lines to get in the propeller). Still, possible fall on your back and damaging the propeller is dangerous (and costly!) so it should be avoided at any price, even that of some damaged lines!

During take-off, when you feel the strain on both risers to be equal, make

sure the canopy is overhead, open up full power and lean back to counter the engine thrust, so that it can push you forward rather than towards the ground. The best option is not to use the brakes, allowing the paraglider to rise as it was laid out. If it starts to swerve from its course, just pull the opposite riser and run under the centre of the wing while preserving starting direction. If the wind suddenly drops, give a stronger pull on the risers. If the paraglider falls to one side or back too far to be lifted again - kill the engine, interrupt launch and check the conditions once again.

As the wing rises, the forces grow lighter and it should stabilise above your head without overshooting. This is the best moment to check if it is inflated well and the lines are not tangled, but do so neither stopping nor turning. Once you feel the forces on the risers decrease, run faster and let go of the risers. See if there is already any opposition on the brakes and, if necessary, use them to correct direction or to increase lift at take-off.

Remember:

- If the cage of your power unit is not stiff enough, the risers strained during launch can deform it to the extent of collision with the propeller. Before giving it full power, see that the cage does not catch any lines.
- Any brake operation (or steering inputs in general) should be smooth and gentle.
- Do not try to take off until you have your wing overhead. Hitting power before that can cause dangerous oscillations.
- Do not sit in the harness until you are sure you are flying!
- The faster the trim setting is, the more brake input is required to take off.
- The lower the hangpoints of your power unit are, the easier is the launch.

Reverse launch in strong wind

Reverse launch can be executed holding in one hand both A risers and one brake, with throttle and the second brake in the other hand. With a decent wind it is by far the best way. In weaker wind it is better to prepare a classic launch, as running backwards with an engine on your back is not an easy thing to do.

It is reasonable not to pull the wing up until you are really determined to launch, especially when it is clipped in.

Lay down the rolled paraglider with its trailing edge against the wind. Unfold the wing enough to find the risers and check that no lines are looped over the leading edge. Stretch the risers against the wind, separating the right and left one.

We suggest that you lay the risers in the same way as you will be turning

during reverse launch, and place one riser over the other, with rear risers upmost. It should be done this way because once you clip in, the cage of your power unit will make turning on your own practically impossible. Now run the pre-launch checklist.

After warming up the engine put the power unit on, turn to face the wing, go to the risers and clip them in the appropriate carabiners. Pulling on the front and rear risers open the cells. It is a good idea to pull up the wing briefly in order to check that the lines are not tangled. Holding the risers, brakes and throttle as described above, pull the front risers and raise the canopy over your head.

On most occasions you won't have have to brake it, especially if the trimmers are set for fast flight (blue areas). Perhaps it does not agree with our experience, but when the trimmers are opened (set above "0"), Nucleon's reflex profile stabilises the wing and does not allow it to surge forward. It can even stay behind a little - in such case pull the brakes a little and the glider will come forward. Once you have it overhead, turn around, open the throttle and take off.

As with the classic launch, in this case too you have to find such combination of trimmers, brakes and throttle settings that will give you the best speed and rate of climb.

Remember:

- You are launching with your hands crossed. You have to really master this technique before trying it with a running engine on your back.
- Any brake operation (or steering inputs in general) should be smooth and gentle.
- Do not try to take off until you have your wing overhead. Hitting the gas pedal before that can cause dangerous oscillations.
- Do not sit in the harness until you are sure you are flying!
- The faster the trim setting is, the more brake input is required to take off.

When clipping in the crossed risers, you can find proper connection of the speed system particularly hard. Be careful not to confuse the risers!

Climbing

Once you took off safely, continue heading against the wind, using brakes to correct rate of climb. Do not try to climb too steeply - attempts to increase climb rate by pulling the brakes will have an adverse effect - due to the additional drag actual rate of climb will worsen, and with the throttle fully opened open even a stall can happen. In powered flight the Nucleon behaves more like an aeroplane than a paraglider, and it is good idea to regard it as such. If there are no obstacles present, it is by far safer (and more impressive for the spectators) to fly level for a while after take-off and gain some speed

before converting it to height with a brief pull on the brakes. Another reason not to try climbing too steeply is the risk connected with engine failure at low altitude. Even as Nucleon in a steep climb does not stay behind as much as conventional paragliders do, the low speed is more likely to cause a stall. Besides, you should always be able to land safely in case of engine malfunction, so it's better not to take unnecessary chances and always fly with a safe margin of speed. Depending on the power unit geometry, it is possible that after take-off you will notice a propeller torque (turning moment). It will try to turn you around, so be counter-steer it with a brake or harness cross-bracing. In Nucleon there is our TEA system present, making possible to counter the torque in case there is no cross-bracing. To make TEA work properly you should assembly the line on proper side (as of propeller direction) and adjust the blocking knot accordingly to torque force. When climbing steeply with slow trim settings and high power output beware of the possibility of stall. Due to typical PPG feature - considerable vertical distance between thrust axis and wing chord - the range of safe power operation is closely connected to your skills and equipment.

Power-unit induced oscillations Certain configurations of engine weight, output and propeller diameter can cause serious oscillations, during which the pilot is being lifted to one side by the torque effect, swings down due to his weight, then is lifted again and so on.

To avoid this you can:

- change the throttle setting and/or
- adjust the cross bracing to counteract the torque, if there is one present and/or
- use the TEA, pulling down the knot through the tube, simultaneously blocking it in the slit and/or
- shift yourself to the other side of the harness and/or
- change the trimmer setting.

The best method is to fasten opposite cross-bracing, or apply some weight-shift. Such oscillations usually occur at full power - the greater the engine output and propeller diameter, the bigger the swings. In addition there are often too late or wrong pilot reactions, increasing the problem instead of solving it. In this case the safest way to deal with this question is to close the throttle and release the brakes.

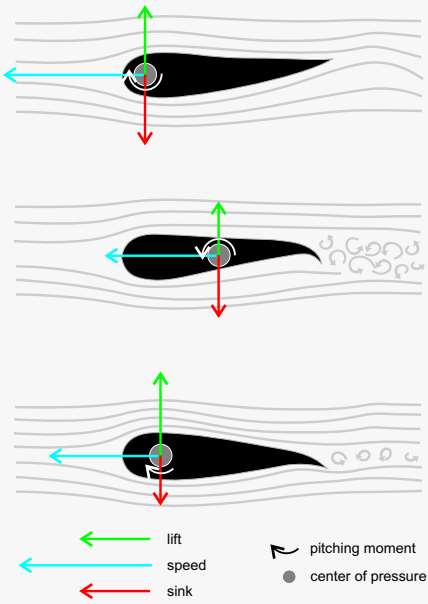
Especially less-experienced pilots tend to overreact. This is called a pilot-induced oscillation, and proven solution is to leave the brakes alone.

3.3.2 LEVEL FLIGHT

Once you have gained safe height after take-off and wish to go for a route, you can turn onto the right direction, fully open the trimmers and let off the brakes.

Influence of classic steering on the reflex profile

Pilots used to classic paragliders tend to fly "active" style, with their brakes constantly tensioned. Flying a reflex wing like that is ineffective and can possibly be dangerous.
Basic rule of reflex paramotoring says: ***the more turbulent it is, the more trims should be released and classic steering should be limited, especially with speed system engaged***.
In such moments paraglider is much more effectively steered by TST or ALC+ systems, designed specifically for that reason.
Problem is illustrated by following drawings:



Released trims without brakes
Typical setting for fast and safe flying. Center of pressure of the aerofoil moves forward, practically excluding collapses. Pitching moment induced by the reflex aerofoil increases angle of attack.

Released trims with brakes applied
Even slight brakes application (especially on full speed bar) shifts the center of pressure back, and due to lack of reflex on trailing edge, pitching moment now decreases angle of attack. Additionally turbulence behind the wing occurs. In some circumstances this can lead to a collapse. Using the brakes can be sometimes necessary for heading corrections, still you should keep your brakes free when flying ahead, otherwise the reflex feature doesn't work.

Closed trims
In this configuration brakes are the normal and prescribed steering system. Slow trim is used for launching in nil wind and thermalling. The canopy behaves similar to classic profile paragliders, with slightly increased tuck resistance.

If the conditions are turbulent, it can look foolhardy, but this is the essential feature of the reflex profile - the faster you fly, the the safer your Nucleon is. That's why it’s truly possible to release the brakes and enjoy your flight.

CAUTION: Some pilots with previous free-flying experience may have a well-grounded habit of keeping the brakes slightly applied at all times. Such a technique, while quite reasonable on a free-flying wings as it allows for quick pilot reactions and decreases sink, is not advisable on reflex-profile paragliders. When you pull the brakes, the Nucleon profile loses its reflex characteristics (see next page).

If you have a variometer or altimeter aboard – watch it. In level flight it is very easy to start climbing unintentionally. The instruments will help you optimise speed and fuel economy.

Of course each flight will depend on current configuration of your gear, but due to its ability to fly safe without constant piloting the Nucleon will let you adjust everything to the best effect.

Good knowledge of weather conditions (e.g. wind at different altitudes) and smart use of thermals, convergence or other kinds of lift will help you greatly reduce fuel consumption and increase flight range. Of course the engine is always there to bring you in the right place.

Do not hesitate to lead the Nucleon into tight thermalling in order to win some altitude and spare fuel - you will be surprised how efficient it is. Possible closing the trimmers will make the climb ratio even better.

Trimmers and speed-system operation

The reflex wing airfoil enables the Nucleon pilot to use a wide range of trimmers and speed-system action. You are free to experiment with all possible settings, as long as you are on safe altitude. **Fully opened trimmers** (blue area) increase the speed and stability of the wing, and with it also its ability to cope with turbulences and overall penetration. As forces on the brakes grow at high speeds, the weightshifting or steering with ALC+ system becomes increasingly effective.

ALC+ system can be used in all trimmers and speed system settings, also in combination with main steering handles when trimmeri is closed. At maximum speedbar and/or fully opened trims we strongly recommend steering with ALC+ system (especially in rough air). Turns executed in this way will be slightly wider, but strength needed to initiate the turn will be smaller and there will be no decrease in speed. **It is advised to use the speedsystem with fully or half opened trimmers.**

Using speedbar with closed trims (red area) can lead to a frontstall, especially in lower parts of start weight range). On the other hand, slow trimmer settings (red area) decreases sink and steering forces, so it is possible to efficiently use the thermals.

Worth noting is the Nucleon impressive speed range - the maximum speed is almost three times greater than stall speed.

Study drawings of trimmers and speed-system adjusting and setting, as well as their influence on the wing shape. Independent of the current wing configuration and speed, turns can be much tightened and more effective with differential brake operation. Slight use of the outer brake (with considerable amount of the inner one) will diminish the loss of lift in turn. Turns can be much improved by additional use of throttle, speed-system etc.

Once with growing experience you will master these techniques, you will be able to execute fully coordinated and effective turns, bringing to mind the aeroplane handling.

REMEMBER:

- Trimmer setting is another part of the pre-start check list!
- If it will be asymmetric, the wing will be turning all the time. And if you will inadvertently set them off, the reflex profile of the Nucleon will keep the wing level, so after opening the throttle you'll start to descend with increased speed instead of climbing.

3.3.3 LANDING

In PPG flying there are two kinds of landing: with and without power.

Power off landing

At an altitude of 50 metres switch the engine off and glide as you would on a conventional paraglider. It reduces the chances of damaging the propeller on landing, but on the other hand there is only one attempt possible - so it has to be done right! With or without power Nucleon better copes with turbulence on open trimmers (blue area). So, if the conditions are rough, better make an approach with greater speed, plan a lot of free space (as for a hangglider) and wear that speed off before touching down. Nucleon preserves the energy well, so there is a long float necessary, exchanging the abundant speed for lift with your brakes. If the landing field is not big enough and you have to land on the spot, we advise you to set the trimmers in red area. It will increase lift coefficient of the wing, effectively decreasing its sink rate and speed. Such an action is especially important when flying with high surface loading.

Powered landing

Make a flat approach with the engine idling, then level out and lose the speed before final flare. Immediately after touchdown switch off the engine. The main advantage of this procedure is of course the possibility of a repeated approach if anything goes wrong. Still, if you forget to switch off the ignition before the wing falls down, there is a considerable risk of damaging propeller, catching lines in it or even suffering injuries connected with falling on your running engine.

Remember:

- Whenever possible, get to know the landing field before taking off.
- Check the wind direction before planning the approach.
- Landing with power off requires much less space.
- In case of any doubt, practice the landing until you feel totally safe.

3.3.4 GOLDEN RULES!

- Never place the power unit downwind of the paraglider.
- Check, double check and then check once again if there is no fuel leakage.

- Do you have enough fuel for the flight? It is always better to have toomuch than too little!
- Check if there is nothing loose in the harness, that could possibly contact the propeller in flight.
- Whenever you encounter a problem, fix it AT ONCE however small it is!
- Always put on and lock the helmet before getting in the harness.
- Before each launch run a full pre-flight inspection.
- After landing, control the wing facing the direction of flight, as on turning you always risk getting lines in the propeller. Turn only if there is danger of falling on your back.
- Do not ask for trouble - do not fly over water, between trees or power lines and other places where engine failure will leave you helpless.
- Mind the turbulence caused by other gliders or even by yourself, especially when flying low.
- It is not reasonable to let go of the brakes below 100 meters, because a possible power unit malfunction may require immediate attention.
- In general never trust your engine, as it can stop at any moment. Always fly as if it’s exactly what it's going to do.
- Unless it is absolutely necessary (e.g. collision avoidance), do not execute tight turns against the torque direction. Especially when climbing you can easily enter a stall and consequent negative spin.
- Do not fly with tail wind at low altitudes, as it pretty much narrows your options !
- Do not wait for the problem to grow - any change of engine sound or a vibration can indicate troubles. You'll never know until you land and check it out!
- Be certain of your navigation
- Remember that not everyone is fond of your engine noise. Do not scare the animals.

3.4 QUICK DESCENT METHODS

3.4.1 BIG EARS

In order to get the big ears you have to pull down the outer lines of the A' risers (distinguished by neoprene sheath) by some 20-50 cm. While inducing big ears you should never let the brakes out of your hands.

After tucking the tips in, Nucleon will continue to fly straight with increased

sink rate (up to 5 m/s). You can steer the wing pretty efficiently by weight-shifting. After releasing lines, the paraglider will usually open up on its own or you can assist it with a long stroke of the brakes. For the sake of safety (the possibility of a parachutal stall) it is reasonable to engage speed system after pulling big ears in order to lessen the angle of attack of the wing centre. Executing big ears with opened trimmers is very difficult due to reflex profile stabilisation.

CAUTION: See the PARACHUTAL STALL chapter.

Never try to pull big ears during powered climb, as the increased drag can lead to increase of the angle of attack and a parachutal stall.

Besides, pulling the ears while climbing is pointless anyway.

3.4.2 SPIRAL DIVE

Nucleon is a very agile paraglider, so entering spiral dive happens very quickly and can be surprising for the less experienced pilot. A spiral dive is characterised by reaching the highest sink rates possible. Significant G-forces, however, make it difficult to sustain a spiral dive for long, as will place high loads on both pilot and glider to degree of losing consciousness by the pilot. Never do this manoeuvre in turbulence or at too high bank angles. Control the dive and do not exceed 16 m/s sink. If the dive is not stopping after releasing the brake,assist the glider with the outer one.

NEVER DO BIG EARS IN A SPIRAL! In this manoeuvre smaller number of lines is carrying an excessive load mulitplied by the centrifugal force, what can lead to damage of the lines or even the paraglider itself (load of a single line can be much higher than passed in certification trials (i.e. 8 G).

3.4.3 B-STALL

Executing a B-stall on a Nucleon is very hard due to specific suspension lines location in stabilizers area.

To enter a B-stall, simultaneously pull down both B-risers (red tape) by 10 – 15 cm. The canopy will collapse across the entire span along its B-row, the airflow over top surface will break and canopy surface will be decreased. Forward movement will be almost completely stopped. Further pulling B-risers is not advised, as tests have shown it to increase wing instability. If the canopy forms a horseshoe with both wingtips in front of the pilot, gently apply both brakes to recover.

To exit a B-stall, the risers should be released in a smooth and decisive manner. On quick and symmetrical releasing B-lines the airflow will be reinstated and the wing will surge forward, returning to normal flight. In contrast to standard paragliders, in case of Nucleon there is no need to counter this surge with brakes - yet another asset of the reflex profile!

CAUTION: See the PARACHUTAL STALL chapter. All rapid descent techniques should be practiced in smooth air and only with sufficient altitude only ! Full stalls and spins are to be avoided as recovery procedures, of the extreme manoeuvres, since irrespective of paraglider type they may have dangerous consequences!

BY FAR THE BEST TECHNIQUE IS SAFE AND CORRECT FLYING, SO THAT YOU WILL NEVER NEED TO DESCEND RAPIDLY!

3.5 AEROBATICS

Nucleon was not designed to do any aerobatics.

3.5.1 WING OVER

You make a wingover by performing a series of consecutive, alternating turns with growing bank angle. Too much banking connected with some flaws in co-ordination and execution can evoke pretty dynamic collapse.

CAUTION: Steep turn with bank angle over 60 degrees is a prohibited aerobatic manoeuvre!

3.6 EXTREME MANOEUVRES

CAUTION! EXTREME FLYING MANOEUVRES SHOULD ONLY BE CARRIED OUT DURING SAFETY TRAINING COURSES (SIV, INSTABILITY TRAINING) UNDER PROPER GUIDANCE! WHILE PROVOKING OR EXITING REAL SITUATIONS THERE IS DANGER THAT YOUR ACTIONS WILL PROVE TOO QUICK OR TOO STRONG, SO YOU SHOULD ALWAYS EMPLOY GOOD JUDGMENT, STAY CALM AND TAKE MEASURED ACTIONS.

Since all actions required to exit or prevent dangerous situations on Nucleon are typical and pilots flying this wing should already have proper experience, we are going to describe only the characteristic features of the Nucleon. Description of standard methods dealing with extreme situations can be found in textbooks.

3.6.1 ONE SIDED COLLAPSE

Even when the trimmers are fully opened or the speed system is engaged, collapses practically do not occur and can be induced only by a very strong turbulence.Still, if it happens, a little counter-steering is enough to keep the Nucleon on course. Under normal conditions with collapses up to 50% of the wingspan, Nucleon will reinflate instantly and spontaneously. If it will not happen, you should aid this process by application of brake on the collapsed side.

3.6.2 FRONTAL COLLAPSE

The reflex profile of the Nucleon makes it practically impossible, especially at higher speeds. During tests we succeeded in creating this situation only with fully closed trimmers and using special measures. Such forced collapses can

lead to extremely deep collapses, so recovery will require decisive pilot action (short and equal application of both brakes).

3.6.3 FULL STALL AND NEGATIVE SPIN

Practically do not occur, may happen only as a result of serious neglect or intentional action of the pilot. You have to be careful when flying at low speeds until fully familiar with brake operation. Wing recovers spontaneously in initial phase of stall, otherwise use standard procedures.

3.6.4 DEEP STALL

Under normal conditions does not occur. If you want to prevent it happen at all, simply stick to a couple of rules:

- after B-stall, release the risers quickly and evenly. Don't be afraid - Nucleon does not jump forward excessively.
- after big ears execution, engage the speed system. This will increase both the sink rate and safety margin, as big ears constitute an aerodynamic brake with significant loss speed.

Nevertheless, if such a parachutal stall happens e.g. due to strong turbulence, simply apply some pressure on speed bar and/or push the A risers forward. You can release the trims too.

3.6.5 LINE OVER AND CRAVATTE

Nucleon is a modern wing which, in order to decrease drag, has fewer suspension lines and greater distances between them. Therefore it's always possible that after a tuck one of the stabilisers may tangle in the lines. Usually a couple of pulls with a brake settles the matter.

If it's not enough, try to untangle it with big ears or a stronger pull on the risers.In case of any doubts you should seriously consider a rescue chute. It is there as a normal equipment part, not just an ornament.

3.6.6 EMERGENCY STEERING

In case of any malfunction that renders normal steering impossible, you can safely steer and land Nucleon using the D-risers (grey marking) or stabilo lines.

4. PARAGLIDER CARE

Proper looking after your paraglider will prolong life of your Nucleon.

4.1 STORAGE

Nucleon's design incorporates newest technologies, including nylon lines in the leading edge. That's why the paraglider should be carefully packed, with proper conditions ensured for transport and storage.

Basic rules to be followed when folding the canopy:

1. Fold it accordion-wise rib to rib (cell by cell). Do not fold it by halves, placing the stabilizers at the centerline.

2. When a compact package is crated on the longest chord do not roll it, but fold three to four times, from trailing edge towards the leading one.

3. The leading edge reamins on top of folded canopy.

Store the paraglider in a dry place, away from chemicals and UV exposure.
Never pack or store the glider when wet.
Remember that the wing becomes damp also while lying on green grass in direct sunlight.
A good precaution to avoid dampness and/or UV when you have to wait in a start queue is to use quick-pack after rigging up.
Always dry the glider thoroughly before packing and/or storage. Never pack you paraglider too tightly.
While drying, never expose your paraglider to direct sunlight operation.
Please note that with frequent kiting/groundhandling exercises your paraglider will deteriorate faster due to its repeated rising, falling and being dragged on the ground.

4.2 CLEANING
Clean the paraglider with water and a soft sponge. Do not use any chemicals or alcohol, as these can permanently damage the fabric.

4.3 REPAIRS
Repairs should only be carried out by the manufacturer, authorised distributor or authorised workshop. It is acceptable to fix minor cloth damage with the self-adhesive patches included in the package.

4.4 DETERIORATION: A FEW TIPS!
The Dudek Nucleon is made mainly of nylon - a fabric which, like any other synthetic material, deteriorates through excessive exposure to UV rays that come with the sunlight. Hence it is recommended to reduce UV exposure to a minimum by keeping the paraglider packed away when not in use. Even when packed in a bag, it should not remain in the sun for long.

Nucleon' suspension lines consist of Technora inner core and polyester sheath. Submitting them to excessive loads in flight should be avoided, as it can cause irreversible damage.

Keep the paraglider clean, since getting dust in the lines and fabric will reduce their durability.

Be careful to keep snow, sand or stones from entering the cell openings: their weight can slow or even stall the glider, and sharp edges can damage the cloth.

Prevent lines from catching anything, as they can overstretch or tear. Do not step on the lines.

Uncontrolled strong wind takeoffs or landings can result in the leading edge of the canopy hitting the ground hard, which may seriously damage the ribs, sewing and surface material.

Knots can chafe suspension and/or brake lines.

Check line lengths after tree or water landings, as they can stretch or shrink.

A line plan is included in this manual or may be obtained from the dealer when needed. After landing in water you should check the wing fabric as well, since the wave forces can cause the fabric to distort in some areas. When taking the wing out of the water, always do this by trailing edge, so that water can flow out freely. After a sea landing, rinse the paraglider with fresh water. Since salt crystals can weaken the suspension lines even after rinsing in fresh water, you should replace the lines with new ones immediately after contact with salt water.

Every second year Nucleon should undergo technical inspection by the manufacturer or authorised distributor.

5. TECHNICAL DATA

Nucleon WRC	23	25	27	29	31	34
Certification	-	-	-	-	-	-
Number of cells	62	62	62	62	62	62
Surface area (flat) [m ^{2}]	23,00	25,00	27,00	29,00	31,00	34,00
Surface area (projected) [m ^{2}]	19,66	21,37	23,08	24,79	26,50	29,06
Span (flat) [m]	11,14	11,62	12,07	12,51	12,94	13,55
Span (projected) [m]	8,95	9,33	9,70	10,05	10,39	10,88
Aspect Ratio (flat)	5,40					
Aspect Ratio (projected)	4,07					
Sink rate [m/s]	min = 1,1; trim = 1,2 - 2,0; max = 3,0					
Speed [km/h]	min = 23; trim = 37 - 52; max = 67					
Max. cord [cm]	245,62	256,07	266,12	275,80	285,15	298,63
Min. cord [cm]	49,07	51,16	53,17	55,10	56,97	59,66
Distance pilot to wing [m]	7,02	7,32	7,60	7,88	8,15	8,53
Total line lenght [m]	373,00	388,00	404,00	418,00	433,00	453,00
Weight range [kg]	65-100	75-115	90-130	100-150	120-165	140-195
Weight [kg]	6,3	6,4	6,9	7,2	7,6	8,0
Lines	Technora: 1,2 & 1,3 & 1,5 & 1,8 & 2,3					
Fabric	Dominico tex 34, 38, 41 g/m^2					
	SkyTex Hard 40 g/m^2					
	SR Scrim, SR Laminate 180 g/m^2					
Risers	PASAMON - Bydgoszcz, Polska					

6. WARRANTY AND AEROCASCO

Purchase of a new paraglider is a serious expense for any pilot. That is why we cover our paragliders with extensive warranties and additionally offer an AeroCasco insurance against damage and repair costs.

WARRANTY

Dudek Paragliders guarantees free of charge repairs caused by the material or production faults along following scheme:

For the free-flying paragliders warranty covers **36 months** (3 years) or 300 flight hours (depending on what comes first).If the paraglider is used for powered flights, every hour spent in the air should be counted as two (does not apply to dedicated PPG canopies).

For the PPG paragliders warranty covers **24 months** (2 years)/200 flight hours (depending on what comes first).

For the mountaineering (MPG) and speedflying wings as well as school and profit users warranty covers **18 months** (1.5 year)/150 flight hours (depending on what comes first).

WARRANTY DOES NOT COVER:

- canopy colour fading
- damage caused by chemicals or salt water
- damage caused by incorrect use
- damage caused by emergency situations
- damage resulting from accidents (airborne or not)

WARRANTY IS ONLY VALID IF:

- flight hours are correctly registered in the logbook of the owner (and possible earlier owners), distinctly marking PPG flights,
- the paraglider is handled in accordance with the operating manual,
- the purchaser has not carried out any repair by him/herself (excl. minor repairs with self-adhesive patches),
- carried out any modifications,
- the paraglider can be unmistakably identified
- the paraglider was being inspected according to prescribed timetable.

If you have ought your paraglider second-hand, ask its previous owner of the paraglider for a logbooks copy (total of flying hours since the date of first purchase).

AEROCASCO

Normal warranty does not cover repairs of damages caused by the user or a third party. As costs of such repairs can be considerable, Dudek Paragliders offer an AeroCasco insurance. It covers a one-off repair of any mechanical damage, no matter how big and whoever inflicted them.The only expenses the purchaser has to pay are shipping costs and so-called share-of-cost amount.

AeroCasco can be purchased only for a brand new paraglider (at the paraglider purchase). Its cost is 50 euro.

NOTE: AeroCasco is not available for all paragliders (check this before purchase). It can be obtained for privately used wings only.

AeroCasco applies only to damages that took place during take-off, flight or landing. Obviously, all faults in the material and manufacturing flaws are covered by normal warranty.

When handing the paraglider for the repair you have to present a card confirming its AeroCasco status. After the repair you will have to cover only the share-of-cost value of 50 euro.

AeroCasco is valid for one repair only.There is a possibility to extend AeroCasco for one more year. To do this you have to send your paraglider for inspection not later than a year after the date of purchase. Extension fee is 75 euro (incl. inspection).

Remember to attach the AeroCasco confirmation on expedition.

AeroCasco does not apply to any of the following: theft, colour fading, damage caused by incorrect storage or transport, damage caused by chemicals, salt water and force majeure.

7. WHAT HAVE YOU BOUGHT

The Dudek paraglider that you bought should have the following items:

- the paraglider itself (canopy, lines and risers)
- transport bag (with compression strap)
- MotoBag - specialised double funcion backpack
- a speed system with Easy Catch bar
- a windsock
- a pocket with paper work and repair wallet including:
  - A piece of self-adhesive fabric (10 cm x 37.5 cm) for small repairs. Note that even small tears located in the vicinity of stitches have to be repaired by an authorised service
  - A looped and stitched suspension line longer than the longest line used in the paraglider that is to be used as a temporary replacement. Do not cut it if you have to replace a shorter line, just tie it at the length needed
  - A paraglider passport with entered date of purchase and valid technical inspection (please check the serial number with the sticker on the wing tip)
  - The User Manual you are reading
- Small gifts.

MotoBag

MotoBag is a dedicated solid backpack for PPG wings, made of proven Cordura fabric. Simultaneously it doubles as a quickpack if necessary.

Beside comfortable shoulder straps to hold it traditionally on your back it has side handles too, so that you can carry it like a suit-case when needed.

After turning it inside out it becomes a quickpack that will shelter your unfolded wing when you are in a hurry.

SUMMARY

If you respect the rules of safe flying and proper glider care, you will enjoy many years of pleasant airtime. Still, you must be aware of possible dangers and face them wisely. You must accept the fact that all air sports are potentially dangerous and your actual safety depends solely on you.

We insist that you fly safely, and this concerns both the weather choice and safety margin during all manoeuvres.

FLYING THE PARAGLIDER IS ALWAYS YOUR OWN RESPONSIBILITY.

SEE YOU IN THE AIR!

8. RIGGING TABLES AND SCHEME

The rigging scheme itself is published on the next page, while tables of line lengths you will find on our website **www.dudek.eu**

Lengths are measured with a specialised, computer-operated device. All lines are stretched with a 5 kg load before cutting. Thanks to the abovementioned device and proper procedures, final tolerance of line lengths does not exceed 0.15%.

NOTE: Distances given below are to be understood as distances between connection points. When cutting a line for repair, 20 cm extra must be added, as at each end a 10 cm stitch is required to fix the loop. The only exception is the main steering line (BRP), which is looped only at the upper end, while there is 30 cm left on the lower end for fastening brake handle (this means for this line extra 40 cm is needed).

Length of the steering line is given as for PPG high suspension harness (=longer lines). In case of a low suspension harness, the steering line should be some 15 cm shorter (the point is higher on the line).

TEA
B
B
BD8
BP5
AD8
BP4
AD7
BD7
BRA6
BRT7
BRD3
BRT4
BRT3
BRD2
BRP
BRD1
BRT2
BRT1
ALC+
CD7
CD6
CD5
CP3
DD6
DD5
DP3
BD6
BD5
BP3
AD6
AD5
AP3
A'
A
B
C
D
BP2
BD4
BD3
BP1
AD4
AD3
AP2
AP1
CD4
CD3
CP2
CP1
DD4
DD3
DP2
DP1
BD2
BD1
AD2
AD1
CD2
CD1
DD2
DD1
ED2
ED1

9. RISERS: DESIGN AND ACCESSORIES

Figure 1 Risers in lower hangopint configuration (steering line is led through one pulley only).

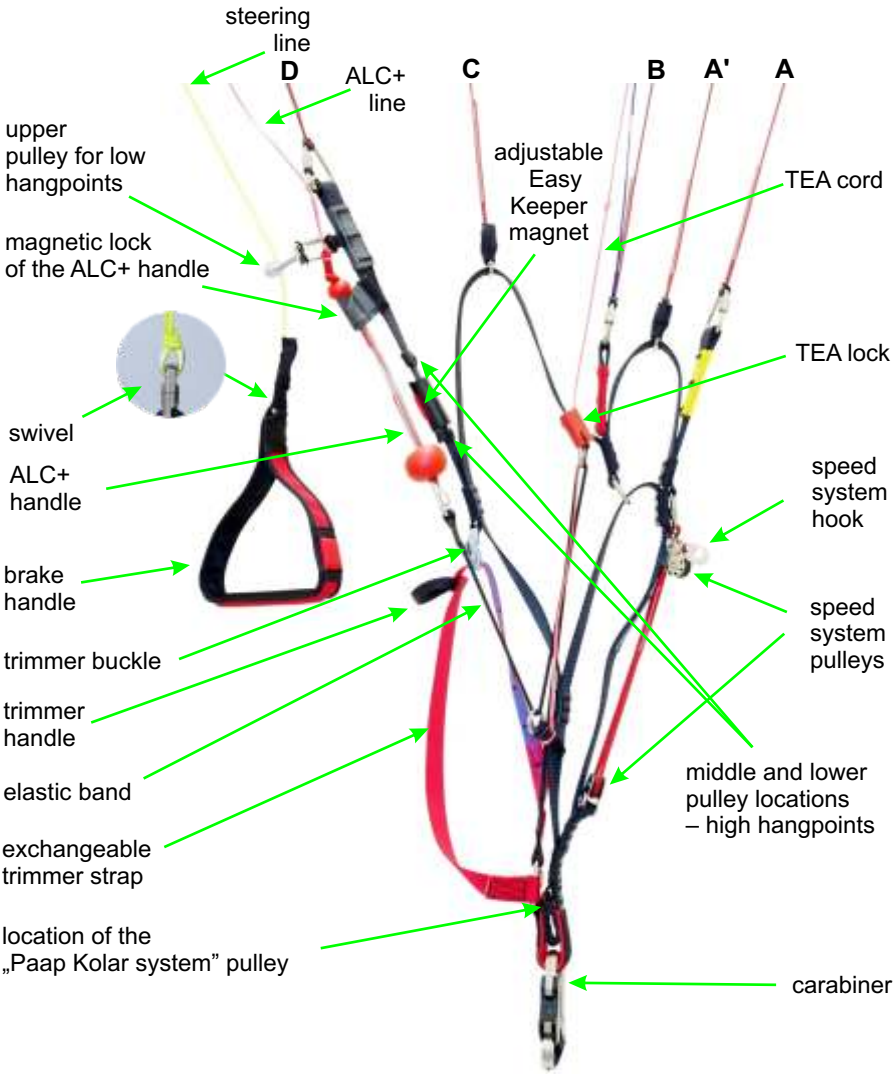


Figure 2
High hangpoints (steering line is led through lower pulley). Magnet in low position.

Figure 3
Low hangpoints (steering line is led through higher pulley). Magnet in high position.

Figure 4 TEA cord inactive (a) and engaged (b)

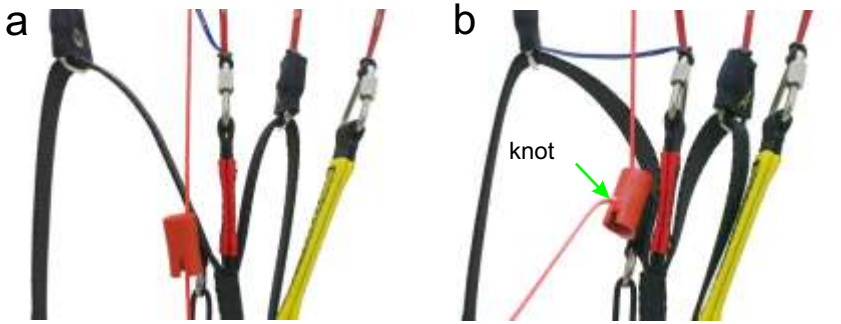


Figure 5
You can reduce drift of the paraglider (contrary to propeller rotation) with TEA or the additional inner loop in the risers hangpoint, visible nearby. Bear in mind though, that with TEA you can set a knot exactly where it's needed to compensate torque accurately, while simple loop does not have any adjustment.

Figure 6
Steering systems scheme

Here is a simple guide to find your way in a maze of risers and their various handles.

Classic brakes operate along entire trailing edge, ALC+ system is active on the outer parts of the trailing edge, and the TEA affects stabilizer only.

With this arrangement the pilot has full range of steering systems at his disposal and can freely choose between them, according to his needs and current situation.

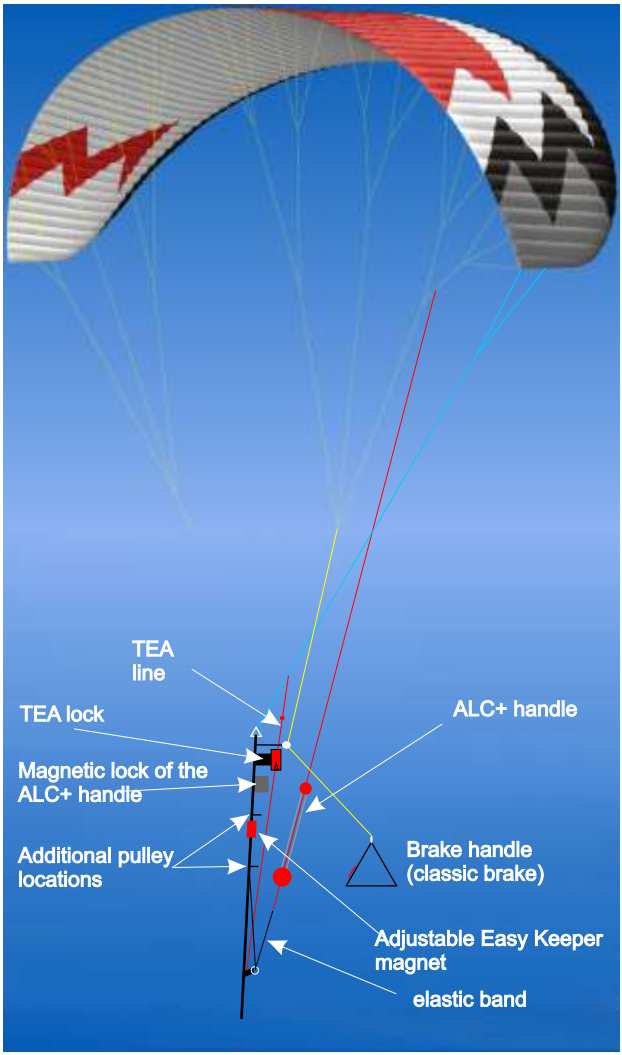


Figure 7 Trimmers influence on the wing profile

Trimmers closed

Minimal speed and
minimal sink
Take-off position

neutral configuration
risers length:
A, A', B: 460 mm

shortening [mm]:

Trimmers in "0" position

Risers of equal length.
Transitional position

neutral configuration
risers length: 460 mm

Trimmers fully opened

Maximum speed

neutral configuration
risers length: 460 mm

lengthening [mm]:

Figure 8 Trimmer settings influence on speed-system action

Lengthening and shortening values are given in respect to neutral risers length: 460 mm

Full acceleration with closed trimmers: good speed, easy steering, decreased stability. Classic speed-system action. This setting is not advised for using speed-system.

shortening [mm]

-60 -75 -90 -130 -170

D C B A' A

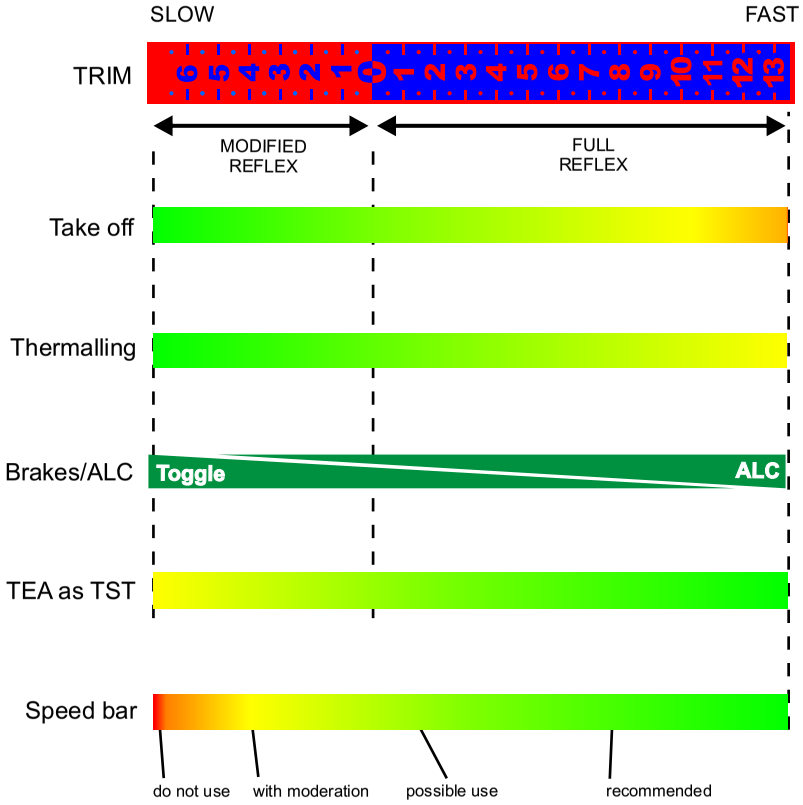
Full acceleration with opened trimmers: small angle of attack, maximum speed. Great stability and hard steering. Advised use of ALC+ system.

lengthening [mm] **shortening [mm]**

+130 +20 -90 -130 -170

D C B A' A

Nucleon WRC - trim usage information



In nil wind conditions, it is preferable to take off with the trims fully closed on Slow. The stronger the wind, the faster the trim setting towards the neutral "0" position. Faster trim settings can render the take off difficult or even impossible, depending on wind strength.

Thermalling the Nucleon is safe at any trim setting. However, the best sink rate is achieved with the trims fully closed on slow. To thermal in turbulence, appropriate release of the trims to a faster setting is recommended to increase stability.

The ALC steering balls allow for lighter handling when used together with the brakes, especially useful at faster trim settings and/or on speed bar. They can also be used on their own to change direction, when not too low near the ground.

In case of harnesses using high hangpoints the TEA system can be used for directional control as well, especially at fast trim and speed system settings. It works in the same way as TST used in our earlier paragliders. Remember though, that TEA must be assembled on both sides to use it in this character.

The speed bar should be used on faster trim settings. It should be avoided on slow trims (zero or slower) when the wing is not in a full reflex configuration, as the risk of collapse may be increased in turbulence.

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